LOW-METALLICITY BLUE COMPACT DWARFS AS TEMPLATES FOR PRIMORDIAL STAR FORMATION

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Understanding how galaxies formed their first stars is a vital cosmological question, but the study of high-redshift objects, caught in the act of forming their first stars, is difficult. Here we argue that two extremely low-metallicity Blue Compact Dwarf galaxies (BCDs), I Zw 18 and SBS 0335-052, could be local templates for primordial star formation, since both lack evolved (> 1 Gyr) stellar populations; but they form stars differently.

The main body of I Zw 18 ($1/50\,Z_\odot$) comprises two star-forming complexes (SFCXs), in the NW and the SE, which are surrounded by a smooth red envelope. Our new deep near-infrared images combined with HST/WFPC2 BVI show that the red extended region is significantly contaminated by ionized gas emission (Hunt et al. 2002). Such emission reddens the observed colors, mimicking the effect of age. Indeed, an analysis of five colors ($B-H$, $V-K$, $V-I$, $J-H$, $H-K$) in terms of stellar populations, extinction, and gas, suggests that the oldest stars in the outskirts of I Zw 18 (and in the detached C component) can be no older than 500 Myr.

Unlike I Zw 18, where there are no super-star clusters (SSCs), virtually all of the star formation in SBS 0335-052 ($1/40\,Z_\odot$) occurs in them. The underlying extended envelope is dominated by ionized gas emission rather than old stars (Vanzi et al. 2000). There is also evidence (Thuan et al. 1999, Hunt et al. 2001) for $A_V = 15$ mag extinction, caused by $10^4 - 10^5\ M_\odot$ of dust. Our Brα measurement suggests that more than 3/4 of the star formation in SBS 0335-052 is obscured by dust, not clearly visible even at 2 μm.

Taken together, these results suggest that I Zw 18 and SBS 0335-052 form stars in very different ways, in spite of their similar metallicity and lack of old stars. We propose that dust and SSCs are associated with an "active" mode of star formation, and the lack of them with a "passive" mode. Theoretical models suggest that the dust content of SBS 0335-052 is consistent with Type II SNe production, and that *high density* and *compact size* of SFCXs favor enhancement of dust shielding in chemically unevolved galaxies (Hirashita et al. 2002). We have investigated this observationally by measuring the sizes of SFCXs in a small sample of BCDs observed with HST/WFPC2 (see Fig. 1). It turns out that size and density (shown in the top panel) are significantly (> 99%) correlated, once we eliminate the uncertain density estimates (VII Zw 403, Mrk 0071-A, Mrk 996). This correlation suggests that compact size and high density could also be hallmarks of the *active* regime.

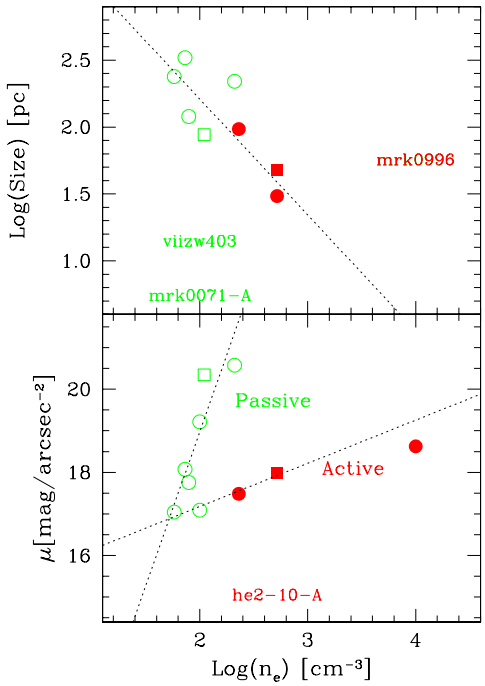

Fig. 1. Size (top panel) and surface brightness (bottom) of the SFCXs plotted against the electron density: I Zw 18 (open square); SBS 0335-052 (filled square).

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